WEBSTER & SONS LTD. INSULATING CONCRETE June 1941 R.A.I.C. No. 4

TARTAN INSULATING CONCRETE

Designed for use in:
Building Construction where high insulating efficiency light weight or sound deadening is required.

WEBSTER & SONS, LIMITED
724 CANADA CEMENT BUILDING
OTTAWA ★ QUEBEC ★ MONTREAL ★ TORONTO ★ TRURO

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TARTAN INSULATING CONCRETE

TARTAN Insulating concrete is an extremely lightweight building material made like ordinary concrete except that specially graded granules of Vermiculite insulation are used as aggregate in place of sand, gravel or stone

WHAT IS VERMICULITE AGGREGTE?

NATURE OF MATERIAL

Vermiculite is an inert, featherweight, resilient material manufactured by exploding an unusual mineral which is an alteration product of mica. It is flaky in structure and is made up of approximately one million separate laminations or layers per inch. Between each lamination is held a tiny amount of water. When small flakes of this ore are suddenly exposed to high temperatures the water held between the laminations changes to steam, expands suddenly and explodes the flakes into cellular granules of Vermiculite insulation about fifteen times their original size.

In the exploding process countless numbers of tiny dead air cells are entrapped between the laminations of the granules and it is from this air cell entrapment that TARTAN obtains most of its insulation value. During the exposure to the intense heat of the manufacturing process the color of the ore changes from dark brown to gold or silver. Due to the fact that the individual laminations of the exploded granules are smooth and bright, It enables them to reflect radiant heat in the same way that a mirror reflects light. By obtaining this dual insulation value in TARTAN it is able to efficiently insulate at all temperatures from subzero to 2000°F. TARTAN melts at about 2500°F.

PHYSICAL AND CHEMICAL PROPERTIES OF VERMICULITE

Vermiculite is fireproof, rotproof, termiteproof, verminproof, odorless, a non-conductor of electricity, chemically inert, and practically non-hygroscopic.

Vermiculite weighs as little as five pounds per cubic foot. It is a clean material and is easy and pleasant to handle.

Being an inorganic mineral Vermiculite does not react with any other substance with which it is placed in contact in its normal use for heat and sound insulation. Vermiculite has passed the Underwriters' Laboratories corrosion tests for thermal insulation materials. It has strong resistance to acids and other highly reactive substances. It does not dissolve, disintegrate, rot nor give off odors when wetted.

The thermal conductivity of Vermiculite loose granular insulation is 0.29 Btu.

USES

In its loose granular form Vermiculite is used extensively as a fill insulation for the walls and roofs of buildings. It also has many applications in industry for the insulation of furnaces, ovens and many types of appliances in both the high and low temperature fields.

In combination with bonding materials it is fabricated into a wide variety of products such as pipe covering, insulating bricks, refractory insulating concrete, high

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TARTAN INSULATING CONCRETE - CONT'D.

temperature insulating cements, insulating and acoustical plasters, acoustical tiles, insulating concrete roof fill and insulating structural roof slabs.

CARACTERISTICS OF TARTAN INSULTING CONCRETE

APPEARANCE

TARTAN Insulating Concrete is light gray in color and has the general appearance of ordinary concrete. Its texture can be made fairly porous or smooth depending upon the proportions of the mix and the type of finish TARTAN Vermiculite concrete aggregate particles usually do not exeed 1/8" in size.

WEIGHT

The porosity of Vermiculite aggregate produces in concrete, by virtue of its lightness and cellular structure, the formation of concrete weighing as little as twenty pounds per cubic foot and having sufficient strength for many uses.

Ordinary concrete weighs about 145 pounds per cubic foot. Cinders, slag and burned clay aggregate produce concrete weighing from 75 to 95 pounds per cubic foot. Since TARTAN Insulating concretes weighing from 20 to 45 pounds per cubic foot can be used successfully in many types of construction, considerable savings in weight and greatly increased insulating value can be obtained through their use.

STRENGTH

The strength and weight of TARTAN Insulating Concrete varies with the proportions of cement used in the mix. For the uses to which Vermiculite is commonly put, namely, insulating roof fill, floor fill, and structural roof deck, densities of 25 to 45 pounds per cubic foot and compressive strengths of 100 to 450 pounds per square inch produce the required results.

The relationship between density and strength for various mixes of TARTAN Insulating Concrete is shown in the graph on page 6.

INSULATING VALUE

Vermiculite aggregate not only imparts lightness to concrete but also remarkably high insulating value. The lighter Vermiculite concrete mixes have excellent insulating value. For exemple, one inch of TARTAN Concrete (density 25 pounds per cubic foot) is equivalent to 16 inches of ordinary concrete in insulating value.

RESISTANCE TO WEATHERING

TARTAN Insulating Concrete has unusual resistance to weathering. Freezing and thawing tests completed through 100 cycles have failed to cause it to rupture or didintegrate.

Being an inert material, moisture or continued wetting does not cause it to react chemically and dissolve or break down.

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TARTAN INSULATING CONCRETE - CONT'D.

TARTAN Insulating concrete has remarkable resistance to cracking caused by changes in temperature. Being a resilient material it takes up ordinary temperature stresses and strains within its own mass without cracking, buckling, or forcing out parapet walls.

USES

TARTAN Insulating concrete is most commonly used for the following purposes.

1. Insulating roof fill for roof insulation. In this use it can also be made to form cants and saddles and produce the proper slopes for roof drainage.
2. Lightweight soundproofing and insulating floor fill
3. Insulating structural roof decks
4. Precast block or tile for:
   - Fireproofing
   - Soundproofing
   - Acoustical correction
   - Thermal insulation

WATERPROOFING

Wetting does not deteriorate TARTAN Insulating concrete but lessens its insulating value and for this reason it should be protected in some way so that water does not enter its cellular structure.

TARTAN Insulating concrete may be waterproofed in two ways:

1. By covering its exposed surfaces with waterproof coatings of paint or built up roofing.
2. By making it integrally water repellent by the use of TARTAN Waterproofing Admix.

Where TARTAN Insulating concrete roof insulation is used for roofs it should be protected by built up roofing which is applied in the same manner as over ordinary concrete roofs. It is also recommended that all TARTAN concrete roof insulation be made water repellent by the addition of TARTAN Waterproofing Admix.

TARTAN Waterproofing Admix is a special type of emulsified asphalt solution specifically designed for use in TARTAN Insulating concrete. It is added to the Vermiculite aggregate, cement and water during the mixing operation so that it integrally waterproofs the concrete.

TARTAN Waterproofing Admix is the only type material which will produce the desired effect in TARTAN Insulating concrete and is recommended exclusively for this purpose.

When the small amounts of TARTAN Waterproofing Admix shown in the standard specifications are added to TARTAN Insulating concrete it becomes highly water repellent. Additional amounts of TARTAN Waterproofing Admix can be used in TARTAN Insulating concrete where additional water repellency is required, but the amount shown in

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TARTAN INSULATING CONCRETE - CONT'D.

the specifications will meet most requirements.

The addition of the Waterproofing Admix effects practically no change in the natural color of the concrete when used in the amounts specified hereafter. It adds greatly to the workability of the concrete and thereby lessens the amount of water required. The Admix does not evaporate and is unaffected by surface temperatures up to 500° F.

COVERAGE

TARTAN Insulating concrete aggregate is scientifically graded to size to produce strength and workability.

About 31 cubic feet of TARTAN Insulating concrete aggregate mixed with the proper proportions of portland cement and sufficient water to form a pouring mix will produce one cubic yard (27 cubic feet) of placed concrete.

When TARTAN Waterproofing Admix is used in TARTAN Insulating concrete only 27 cubic feet of TARTAN Insulating concrete aggregate mixed with the proper proportion of cement and sufficient water to form a pouring mix are required to produce one cubic yard (27 cubic feet) of placed concrete.

WATER RATIO

Due to the larger proportions of aggregate in TARTAN Insulating concrete, compared to ordinary concrete, the wider range of mixes used, and the fact that Vermiculite is a very porous aggregate and presents a greater area to be wetted than solid aggregates thus requiring more water, it is more convenient to base the water ratio on the amount of Vermiculite aggregate used in a mix rather than on the amount of cement as is usually the case.

The water ratio depends upon the amount of workability required in the concrete to meet the conditions of the job and whether or not the concrete contains TARTAN Waterproofing Admix, since TARTAN water repellent concrete requires less water to develop the desired working properties than plain TARTAN Insulating concrete.

PLAIN TARTAN INSULATING CONCRETE

Plain TARTAN Insulating concrete requires 3.2 (Imperial) gallons of water per cubic foot of Vermiculite aggregate to develop a mix of pouring consistency. Water ratios of 2.8 gallons to 3.2 gallons per cubic foot of aggregate may be used to produce a wide range of workability without materially affecting the strength of the concrete. It is recommended that 3.2 gallons of water per cubic foot of aggregate be used wherever possible since this produces a workable mix for most applications having about the maximum possible strength.

TARTAN WATER REPELLENT CONCRETE

TARTAN water repellent concrete requires 2.6 (Imperial) gallons of water per cubic foot of Vermiculite aggregate to develop a mix of pouring consistency. Water ratios of 2 to 2.6 gallons of water per cubic foot of aggregate may be used to produce a wide range of workability without materially affecting the strength of the concrete. It is recommended that 2.6 gallons of water per cubic foot of aggregate be used whereever possible since this produces a workable mix for most applications having about the maximum possible strength.

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TARTAN INSULATING CONCRETE - CONT'D.

- ROOF FILL -

TARTAN Insulating concrete is an ideal material for roof insulation and fill, because of its high thermal resistance, lightness, compression strength and permanence. It is easily formed into cants, saddles and slopes to give proper roof drainage and a monolithic covering of insulation.

INSULATING VALUE

The thermal conductivities of the TARTAN Insulating concrete mixes ordinarily used for insulating roof fill vary between 0.69 to 0.88 Btu.

PERMANENCE

TARTAN Insulating concrete forms a permanent rigid base for roofing materials. It does not dent easily and is not subject to disintegration or decay resulting from wetting, freezing or thawing. Because of its strength and permanence it helps increase the life of roofing by lessening the hazards of punctures, blisters, and leaks.

STRENGTH

The compressive strength of TARTAN Insulating concrete can be made to meet the particular requirements of a job by simply varying the cement ratio in the mix

The greater the proportion of cement used the greater will be the strength and density of the formed concrete but the lesser will be its insulating value.

The recommended and most commonly used mix for insulating roof fill is composed of eight parts of Vermiculite aggregate and one part Portland cement. This mix produces a concrete weighing approximately 24 pounds per cubic foot, having a thermal conductivity of about 0.72 and a compression strength of 140 pounds per square inch.

ROOFING

Roofing materials should not be placed over TARTAN Insulating concrete roof insulation until :

1. The concrete has set up and is hard and strong enough to bear traffic.

2. The surface of the concrete is dry and will take a prime coat so that a good bond to the roofing may be secured.

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TARTAN INSULATING CONCRETE

CHART No.2

Mix By Volume

Cubic Feet TARTAN Vermiculite Concrete Aggregate	Bags Port-land Cement	Gallons Water Per Cubic Foot Vermiculite Aggregate	Quarts TARTAN Water-proofing Admix per bag Cement	Approx. Density in Lbs. per cu. foot.	Compressive strength in lbs. per square inch.	Thermal Conduct-ivity (K) in B.T.U./ Sq./ Ft./ In./ Hr./ Degree F.	Materials Required for One Cubic Yard of placed TARTAN Water Repellent Insulating "CONCRETE"			
							Cubic Feet Vermiculite Aggregate	Bags Portland Cement	Gallons TARTAN Water-Proofing Admix	Gallons Water
10	1	2.6	6.4	22	115	0.69	27	2.7	4.3	70.5
9	1	2.6	6.	23	125	0.70	27	3.0	4.4	70.5
8	1	2.6	5.6	24	140	0.72	27	3.4	4.8	70.5
7	1	2.6	5.2	25	150	0.73	27	3.9	5.0	70.5
6	1	2.6	4.8	26.5	165	0.755	27	4.5	5.4	70.5
5	1	2.6	4.4	30	240	0.805	27	5.4	5.9	70.5
4	1	2.6	4.	35	340	0.88	27	6.8	6.8	70.5
3	1	2.6	3.6	41	465	0.965	27	9.0	8.0	70.5
2	1	2.8	3.2	48.5	575	1.08	27	13.5	10.8	76

(ALL LIQUIDS IN IMPERIAL MEASURE)

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TARTAN INSULATING CONCRETE - CONT'D

TARTAN Insulating concrete roof fill or structural deck need not be completely dried out before application of roofing provided the surface of the concrete is firm and dry and will take a strong bond with the primer coat.

Drying tests run by the Rush Engineering Company on TARTAN concrete in open air at room temperature (about 70°F.) showed the following average results:

Drying Period in Days	Percent Water Content
0	100.0
7	24.3
14	16.5
21	8.8

In preparation for roofing the surface of TARTAN Insulating concrete shall be screed and floated to a uniform surface without bumps or holes. A wood float finish is preferable to a steel trowel finish.

Cant strips of TARTAN Insulating concrete can be poured at the same time as the roof fill or later. The mix used in the cant strips should be the same as in the roof fill.

The entire TARTAN Insulating concrete roof surfaces shall receive a primer coat of approved type concrete roof primer after which roofing shall be laid in accordance with manufacturers' standard specifications. Roof primer shall not be applied until the surface of the TARTAN Insulating concrete is dry so that good adhesion is formed between the concrete and the primer.

The roofing contractor shall examine all TARTAN Insulating concrete surfaces upon or against which roofing is to be applied. He shall determine that the slopes to drains are constructed to specifications, the surface of the deck is dry, smooth and free from projections above or depression in the plane of the deck surface, the deck is free from rubbish and debris and ready to receive the roofing material. He shall notify the architect of any defects he considers detrimental to the installation of the roofing materials and shall make sure that all defects are corrected before he begins work. The application of the roofing materials by the roofing contractor will be considered acceptance by him of the roof deck as constructed.

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TARTAN INSULATING CONCRETE - CONT'D

-SPECIFICATIONS-

MATERIALS

TARTAN Insulating concrete shall be composed of TARTAN Concrete Aggregate, Portland Cement and water.

TARTAN Waterproofing Admix shall be added to TARTAN concrete mixes where water repellent properties are desired.

Vermiculite Concrete Aggregate

Vermiculite aggregate shall be specially prepared, accurately graded for size and practically free from stone, non-insulating, organic or combustible material.

Portland Cement

Portland Cement shall be standard grade and quality. Either "ordinary set" or "high early strength" grades shall be used. Only one brand of cement shall be used in any one continuous placing.

Water

Water shall be clean, fresh and free from oil, acids, vegetable, sewage, alkali, organic or other deleterious material.

TARTAN WATERPROOFING ADMIX

TARTAN Waterproofing Admix shall be emulsified asphalt solution of exclusive type prepared specifically for use with TARTAN Vermiculite concrete aggregate.

PROPORTIONS

The proportions of material in the mix shall be:

... cubic feet TARTAN concrete aggregate
... bags Portland cement
... gallons water
... gallons TARTAN Waterproofing Admix

MIXING

TARTAN Insulating Concrete shall be mixed by hand or in a mechanical mixer.

Mechanical Mixing

Where a mechanical mixer is used the proper amount of water shall first be put into the mixer.

The Portland cement shall next be added and thoroughly mixed with the water.

The TARTAN Waterproofing Admix (if any) shall be added and thoroughly mixed with the cement and water.

The Vermiculite aggregate shall finally be added and mixed only long enough to distribute the moisture uniformly throughout its mass.

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Hand Mixing

Plain TARTAN Insulating Concrete

The proper proportions of dry Vermiculite and cement shall be placed on a clean floor or other surface or in a mixing box and turned over at least three times before the water is added and as many times as is necessary after the addition of the water to obtain even distribution of water and cement throughout the mass of material.

Water Repellent TARTAN Insulating Concrete

1. Mixing Box Procedure

TARTAN water repellent Insulating concrete shall preferably be mixed in a clean, watertight mixing box. The proper proportions of Portland cement and water shall first be mixed in a box

The TARTAN Waterproofing Admix shall next be added and thoroughly mixed with the cement and water

The Vermiculite concrete aggregate shall finally be added and turned over in the box a sufficient number of times to obtain even distribution of cement, water and Waterproofing Admix.

2. Floor Mixing Procedure

The proper proportions of dry Vermiculite and cement shall be placed on a clean floor or other surface and turned over at least three times to obtain even distribution.

The proper proportions of TARTAN Waterproofing Admix and water shall be mixed separately in a clean, watertight container and than added to the premixed Vermiculite aggregate and cement. The wetted mixture shall finally be turned over as many times as is necessary to obtain even distribution of moisture and material.

PLACING AND CURING

TARTAN Insulating concrete shall be placed without rodding, tamping, or vibration, unless so specified.

TARTAN Insulating concrete shall be protected from heat, wind, rain, and cold during the setting period and first stages of hardening

It shall not be placed when the outside temperature is lower than 40°F, unless adequate protection is provided to keep it from freezing and sufficient heat is available to set up the cement.

TARTAN Insulating concrete shall be protected from heat and wind so that it is prevented from drying out for at least three days. Where air temperatures are above 70°F, protection curing shall be continued for an additional seven days.

FINISHING

TARTAN Insulating concrete shall be finished by steel or wood float, screed or steel trowel dependent upon the use to be made of the surface

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TARTAN INSULATING CONCRETE - CONT'D

- STRUCTURAL ROOF DECK -

The deck is installed over removable forms for roof slabs having spans from three feet to eleven feet.

This type deck is desirable where the underside of the slab is to be exposed as the finished ceiling or acoustical values are required. Because minimum slab thicknesses of 3" are used this type deck is desirable where high insulating value is required.

Chart No. 1 gives the design data for various spans of this type of deck. This data is for slabs designed to carry minimum ultimate loads of 200 pounds per square foot or live loads of 40 pounds per square foot with a safety factor of five.

SPECIFICATIONS FOR SIMPLE SLAB DESIGN

TARTAN Insulating Concrete

TARTAN concrete shall be made of the following proportions:

5 Cu. Ft. TARTAN Vermiculite Concrete aggregate
1 Bag Portland Cement
4.4 Quarts TARTAN Waterproofing Admix
2.6 Gals. Water per cubic foot Vermiculite aggregate

TARTAN Insulating concrete slab thicknesses shall be as shown in the chart above for various spans.

An asphalt expansion joint strip ¼" thick, having a width 1½" less than the thickness of the TARTAN Insulating concrete slab shall be placed vertically over the center of each intermediate support in order that simple span action may be assured.

Main Reinforcing Steel

Reinforcing steel shall be of intermediate grade and preferably deformed. The size and spacing of reinforcing rods shall be as shown in above table. Reinforcing shall be placed to have a covering of 3/4" concrete between the bottom side of the reinforcing and underside of the slab.

Reinforcing rods shall have hooked ends. To form hooks, rods shall be bent in a full semi-circle with a radius of bend not less than three times the diameter of the rod, plus an extension at the free end of at least four times the rod diameter.

The end of the hook shall have a minimum covering of 3/4" concrete between upper side of reinforcing and upper side of slab and a covering of 1" on the end of the slab.

Main reinforcing shall preferably extend complete distance from one side of slab to the other. Where slabs are of such size that it is not practical to have the

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TARTAN INSULATING CONCRETE - CONT'D

- STRUCTURAL ROOF DECK -

steel extend the entire width of the slab the reinforcing shall be made in convenient lengths provided the ends are hooked as specified above and spliced directly over structural supports. Not over 50% of reinforcing shall be spliced over any one support.

Steel shall be securely fastened in position to prevent movement during pouring of concrete.

Temperature Steel

Temperature steel shall be of intermediate grade and preferably deformed. The size and spacing of steel shall be as shown in above table.

Temperature steel shall be placed on top of and at right angles to the main steel and be securely fastened in place to prevent movement during pouring of concrete.

Where it is not practical to use temperature steel the full length of the slab, splices shall be made. Splices shall be staggered and steel rods shall be lapped a distance equivalent to at least 60 times the diameter of the steel.

Forms

Forms shall be made of wood or metal having sufficient strength to prevent undue delection and shall be sufficiently tight to prevent leakage of concrete. If the underside of the TARTAN Insulating concrete slab is to be exposed, plywood or Presdwood forms are recommended.

Forms shall not be removed for at least seven days after concrete is placed if high early strength cement is used or fourteen days if ordinary cement is used.

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DATA FOR VARIOUS SPANS OF TARTAN INSULATION CONCRETE STRUCTURAL ROOF DECK

CHART NO. 1

Maximum Span in Feet	Total Slab Thickness In Inches	Effective Depth of Slab in Inches	Main Steel Requirements			Temperature Steel Requirements			Total Weight of Slab per Square Foot Including Steel and Roofing	Overall Thermal Conductivity in B.T.U./Sq. Ft./Hr./In./Degree F.
			Square Inches of Steel per Lineal Foot Width of Slab	Rod Sizes	Rods Spacings on Centers	Square Inches Of Steel per Lineal Foot Width of Slab	Rod Sizes	Rod Spacings on Centers		
L	D	d								
3	3	2	0.144	1/4"Ø	4"	0.072	1/4"Ø	8"	15	.190
4	3	2	0.144	1/4"Ø	4"	0.072	1/4"Ø	8"	15	.190
5	3½	2½	0.180	3/8"Ø	7-1/4"	0.084	1/4"Ø	7"	16	.170
6	4	3	0.216	3/8"Ø	6"	0.096	3/8"Ø	12"	18	.154
7	4½	3½	0.252	3/8"Ø	5"	0.108	3/8"Ø	12"	19	.140
8	5	4	0.288	3/8"Ø	4-1/2"	0.120	3/8"Ø	11"	20	.129
9	5-3/4	4-3/4	0.342	3/8"Ø	3-3/4"	0.138	3/8"Ø	9½"	22	.116
10	6¼	5¼	0.378	1/2"Ø	6"	0.150	3/8"Ø	8-3/4"	24	.108
11	7	6	0.432	1/2"Ø	5-1/2"	0.168	3/8"Ø	8 "	26	.098

Span - Distance between centers of members supporting slabs.

Total weight of roofing and gravel figured at 7 lbs. per square foot.

Includes built-up roofing (C = 1.33 R = 0.75) Inside air film Fi.

(C = 1.65 R = 0.61) and outside air film Fo (C = 6.0 R = 0.17)

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TARTAN INSULATING CONCRETE - CONT'D

- PRECAST STRUCTURAL ROOF SLABS -

TARTAN Insulating precast structural roof slabs are used where the poured in place type of deck is impractical or weather conditions will not permit placement of insulating concrete on the job.

For TARTAN Insulating roof slabs use a concrete mix of the following proportions:-

5 Cu. Ft. TARTAN Vermiculite Concrete aggregate
1 Bag Portland cement
4.4 Quarts TARTAN Waterproofing Admix
2.6 Gals. (Imp.) water per cubic foot Vermiculite concrete aggregate.

The slabs shall not be made more than (3 feet) wide and shall not require temperature steel. See chart No. 1

Reinforcement of slabs shall be entirely continuous and hooked on ends.

FORMS

Forms shall be made of wood or metal and be supported to prevent deflection so that plane surfaces are obtained on all sides of the slab.

FASTENING OF SLABS

Where slabs are placed on horizontal areas no fastening device shall be required. Where slabs are placed on areas having slopes greater than 10 degrees the ends of the slabs shall be recessed 3/8" where they rest on supporting members or be fastened with other mechanical anchorage of approved type.

CURING AND FINISHING

Slabs can be removed from forms within 24 hours if high early strength cement is used and within 48 hours if ordinary cement is used.

Curing shall be the same as for concrete in type 1 deck specification.

Slabs made with high early strength cement shall not be erected on roof for at least 7 days after manufacture and slabs made with ordinary cement shall not be erected for at least 14 days after manufacture.

Surfaces of slabs shall be finished smooth with a wood float.

After erection all joints, chipped edges or other irregularities in the slabs shall be filled or patched smooth with TARTAN Insulating concrete of the same mix of which the slab is composed. Roofing shall be applied according to manufacturers' standard specifications.

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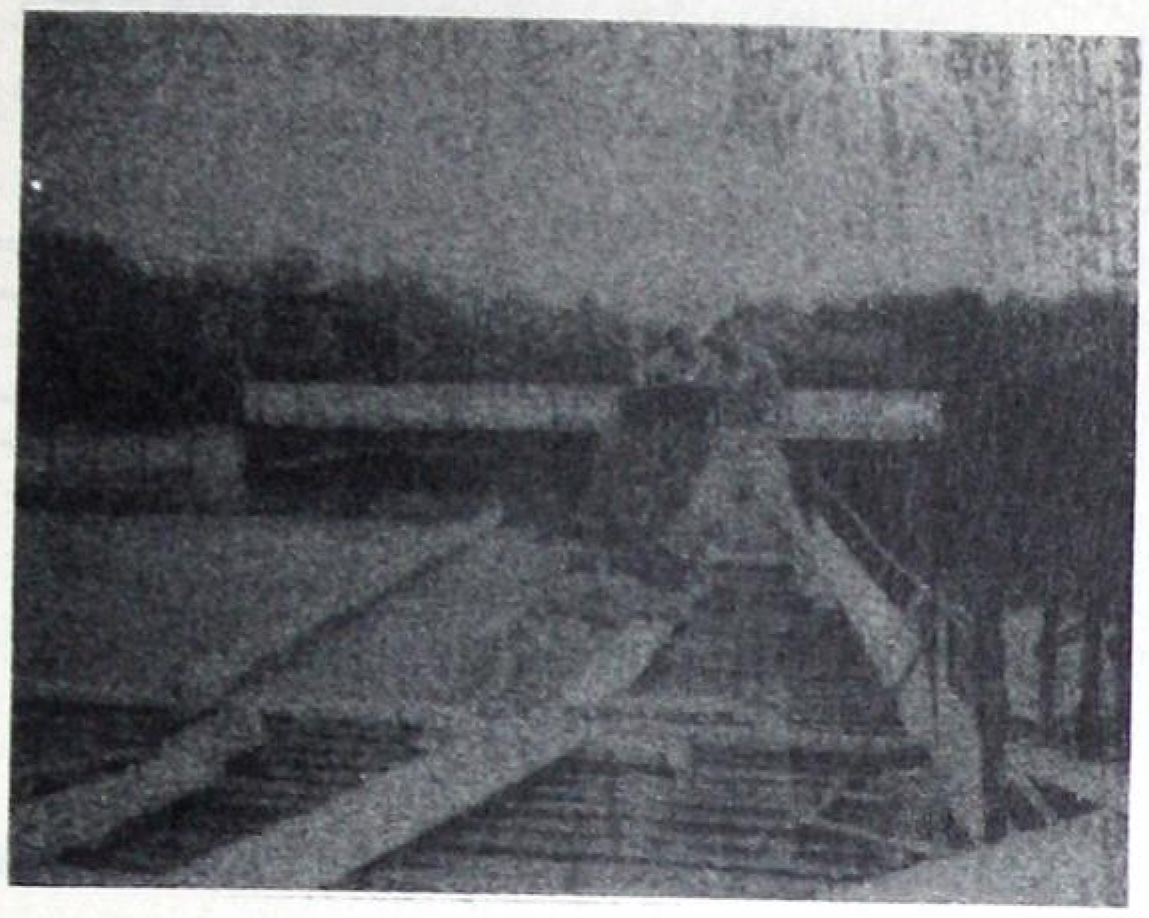
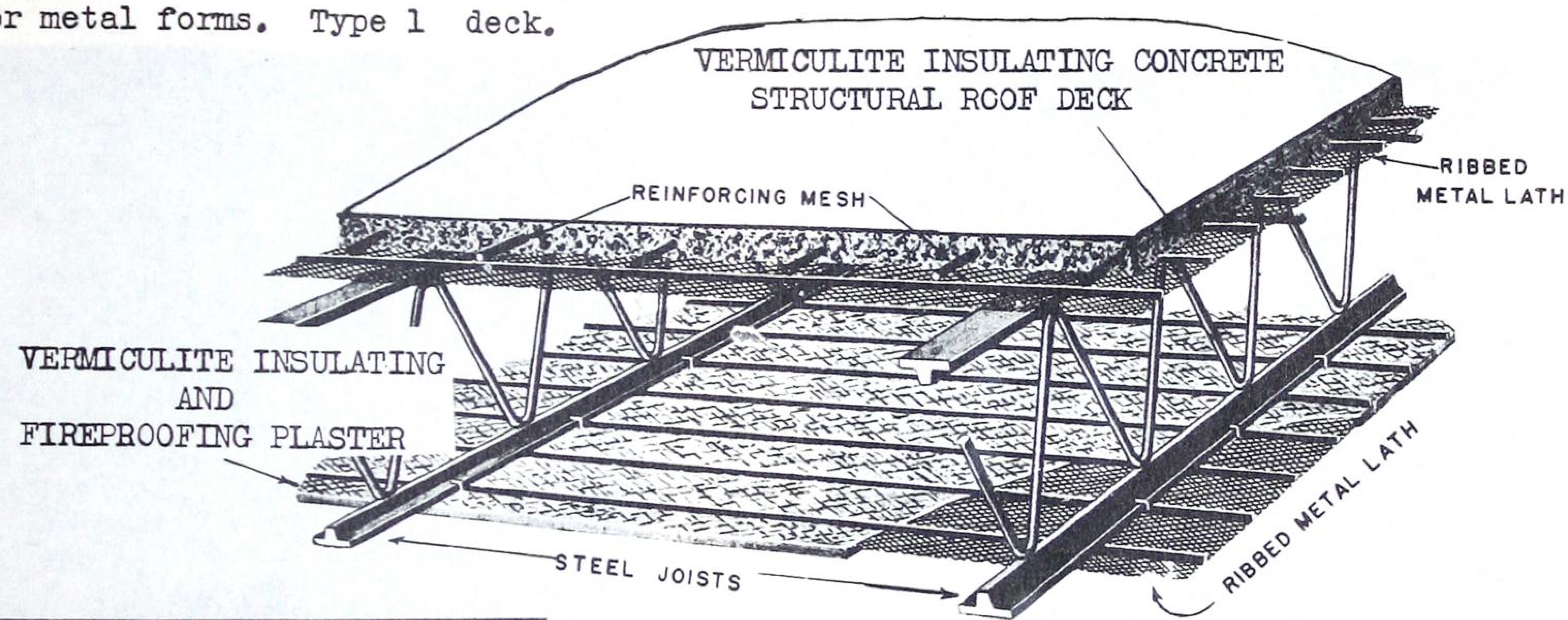
VERMICULITE INSULATING CONCRETE
"ROOF DECKS"



Type 1. Deck poured monolithically into place over metal lath, gypsum boards or other suitable materials which serve as the forms and become an integral part of the roof deck construction.

Placing Vermiculite concrete deck over metal forms. Type 1 deck.



Method of fastening Steeltex to joists with metal clips.

The overall thermal conductance for this type deck including built up roofing and surface air films shall be approximately 0.249, 0.216, and 0.190 B.T.U. for the 2", $2\frac{1}{2}$" and 3" slab thicknesses respectively.

The total weight of this type deck per square foot shall be approximately 13, $14\frac{1}{2}$ and 16 lbs. per square foot respectively for the $2\frac{1}{2}$",and 3" thick decks. The above weights include the Vermiculite concrete, Steeltex and built-up roofing covered with gravel.

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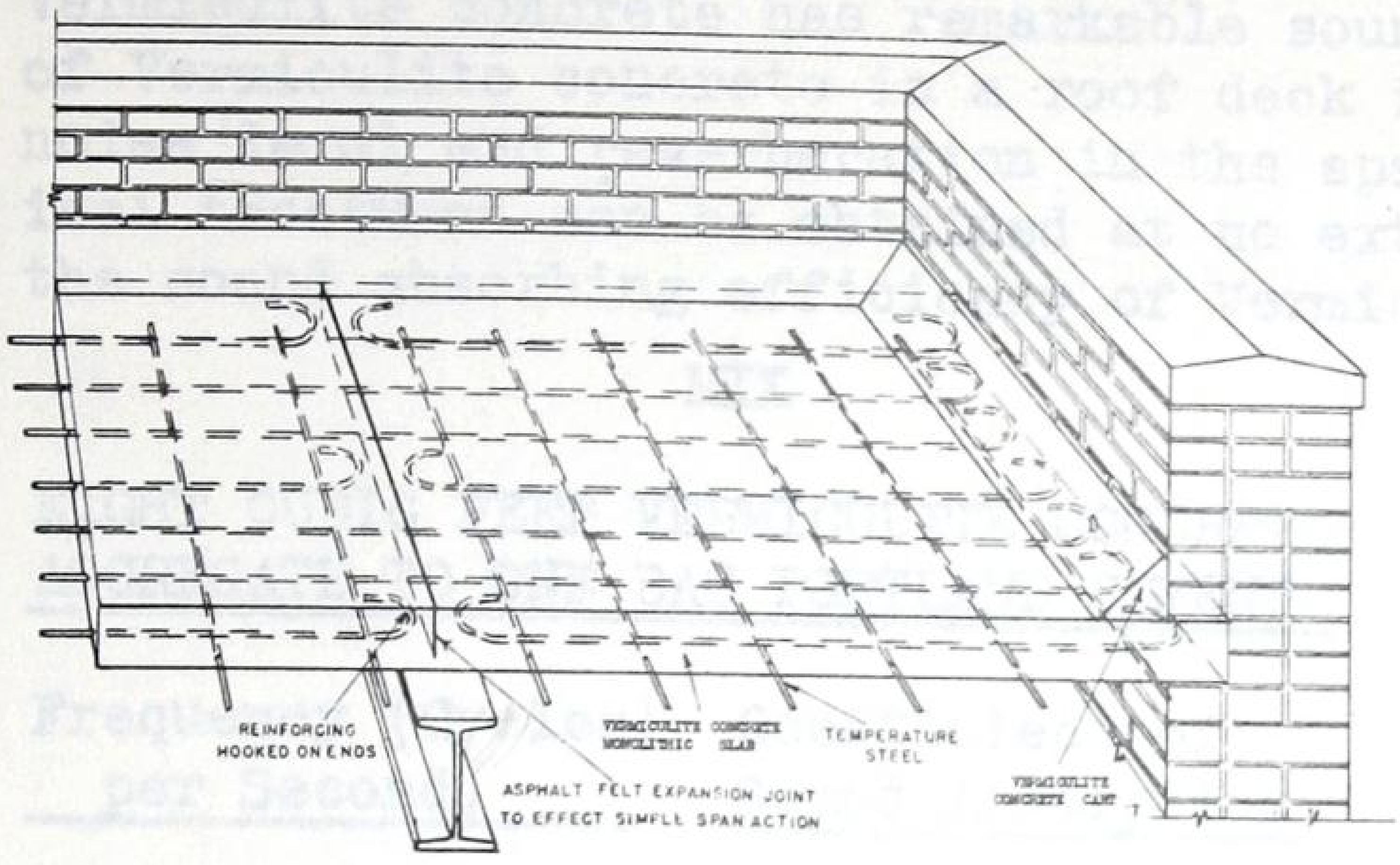
VERMICULITE CONCRETE STRUCTURAL ROOF DECKS

"TYPE 2."


REINFORCING HOOKED ON ENDS
VERMICULITE CONCRETE MONOLITHIC SLAB
TEMPERATURE STEEL
ASPHALT FELT EXPANSION JOINT TO EFFECT SIMPLE SPAN ACTION
VERMICULITE CONCRETE CANT

VERMICULITE CONCRETE MONOLITHIC STRUCTURAL ROOF DECK

Type 2 Deck is installed over removable forms for roof slabs having spans from three feet to eleven feet.

This type deck is desirable where the underside of the slab is to be exposed as the finished ceiling or acoustical values are required. Because minimum slab thicknesses of 3" are used in Type 2 deck it is desirable where high insulating value is required.

Chart No.1 gives the design data for various spans of Type 2 deck.

Underside of roof deck showing wood forms in place ready to receive Vermiculite concrete. Type 2 Deck.

Placing Vermiculite concrete over wood forms to form structural roof deck. Type 2 Deck.

FORMS

Forms shall be made of wood or metal having sufficient strength to prevent undue deflection and shall be sufficiently tight to prevent leakage of concrete.

If the underside of the Vermiculite concrete slab is to be exposed, plywood or Presdwood forms are recommended.

Forms shall not be removed for at least seven days after concrete is placed if high early strength cement is used or fourteen days if ordinary cement is used.

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VERMICULITE INSULATING CONCRETE

ACOUSTICAL PROPERTIES

Vermiculite concrete has remarkable sound absorbing efficiency. When the underside of Vermiculite concrete in a roof deck is exposed, it can effectively reduce the noise level and reverberation in the space below. In this way, an excellent acoustical treatment can be obtained at no extra cost. The following test results show the sound absorbing efficiency of Vermiculite concrete.

MIX

EIGHT CUBIC FEET VERMICULITE CONCRETE AGGREGATE TO ONE BAG PORTLAND CEMENT

Frequency (Cycles) per Second)	Coefficient of Sound Absorption
128	.32
256	.78
512	.78
1024	.64
2048	.62
4096	.63
Noise Coefficient	.70

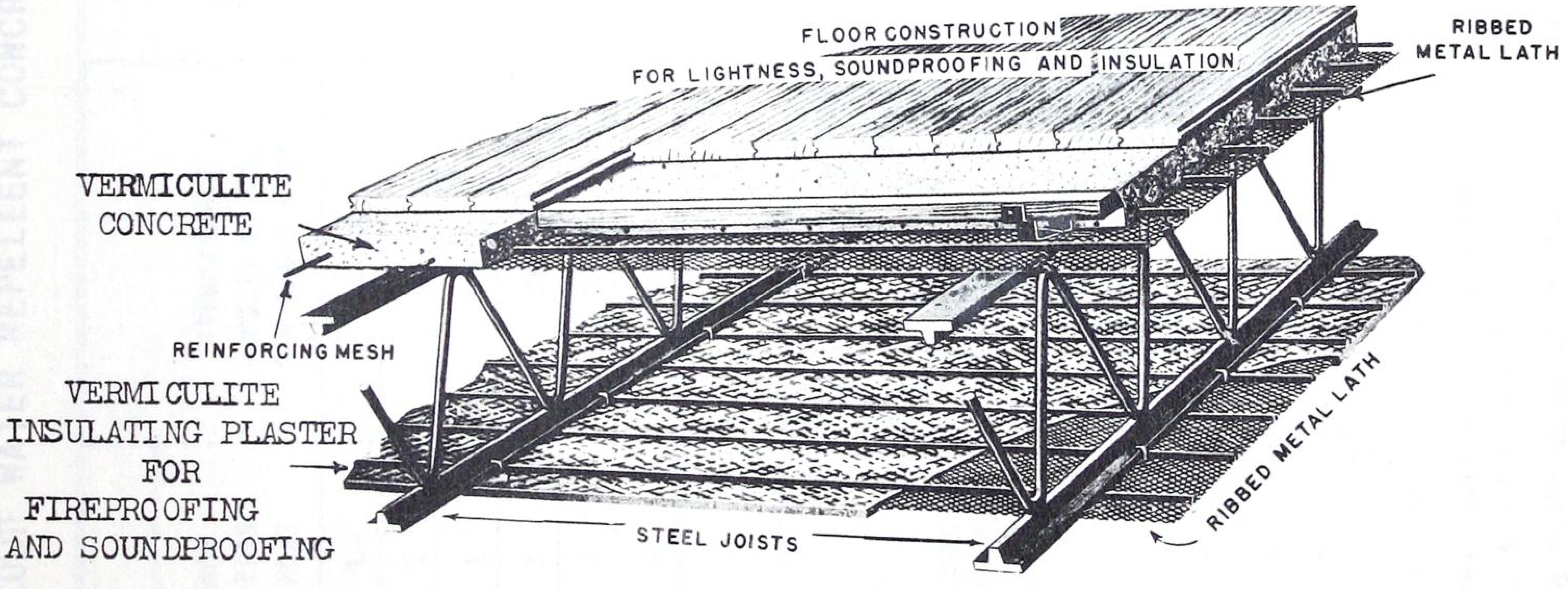
MIX

FIVE CUBIC FEET VERMICULITE CONCRETE AGGREGATE TO ONE BAG PORTLAND CEMENT

Frequency (Cycles) per Second)	Coefficient of Sound Absorption
256	.25
512	.70
1024	.60
2048	.55
Noise Coefficient	.50

Vermiculite concrete can also be used for acoustical treatment below ordinary structural concrete slabs by placing it 1" to 2" thick on top of removable forms and then pouring the regular structural concrete on top of it.

VERMICULITE STRUCTURAL CONCRETE


FLOOR CONSTRUCTION
FOR LIGHTNESS, SOUNDPROOFING AND INSULATION
RIBBED METAL LATH
VERMICULITE CONCRETE
REINFORCING MESH
VERMICULITE INSULATING PLASTER FOR FIREPROOFING AND SOUNDPROOFING
STEEL JOISTS
RIBBED METAL LATH

SOUNDPROOFING

Vermiculite concrete has low sound transmission values as indicated in the test figures shown below by Michael Rettinger. The following test results were obtained on a Vermiculite concrete slab 4" thick made of 8 cubic feet Vermiculite concrete aggregate and one bag portland cement.

Frequency (Cycles per Second)	128	256	512	1024	2048	Average Reduction
Transmission Loss in Decibels	28.2	36.3	42.1	47.8	55.7	42.4

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OVER-ALL HEAT TRANSMISSION COEFFICIENTS FOR VARIOUS MIXES AND THICKNESSES OF VERMICULITE WATER REPELLENT CONCRETE COVERED WITH BUILT-UP ROOFING*

MIX BY VOLUME		APPROXIMATE DENSITY IN LBS. PER CUBIC FOOT	WEIGHT PER SQUARE FOOT 1" THICK IN POUNDS	COMPRESSIVE STRENGTH IN POUNDS PER SQUARE INCH	THERMAL CONDUCTIVITY (K) RESISTIVITY (R)	
CUBIC FEET VERMICULITE CONCRETE AGGREGATE	BAGS PORTLAND CEMENT				K	R
10	1	22.0	1.83	115	0.69	1.45
8	1	24.0	2.00	140	0.72	1.39
6	1	26.5	2.20	165	0.755	1.32
5	1	30.0	2.50	240	0.805	1.24
4	1	35.0	2.91	340	0.88	1.14
3	1	41.0	3.41	465	0.965	1.04

MIX BY VOLUME		THERMAL CONDUCTANCE* (C) AND RESISTANCE (R) FOR VERMICULITE INSULATING CONCRETE AND BUILT-UP ROOFING**											
		1"		2"		3"		4"		5"		6"	
CUBIC FEET VERMICULITE CONCRETE AGGREGATE	BAGS PORTLAND CEMENT	C	R	C	R	C	R	C	R	C	R	C	R
10	1	0.335	2.98	0.226	4.43	0.170	5.88	0.136	7.33	0.114	8.78	0.098	10.23
8	1	0.342	2.92	0.232	4.31	0.175	5.70	0.141	7.09	0.118	8.48	0.101	9.87
6	1	0.351	2.85	0.240	4.17	0.182	5.49	0.147	6.81	0.123	8.13	0.106	9.45
5	1	0.361	2.77	0.249	4.01	0.190	5.25	0.154	6.49	0.129	7.73	0.111	8.97
4	1	0.374	2.67	0.262	3.81	0.202	4.95	0.164	6.09	0.138	7.23	0.119	8.37
3	1	0.389	2.57	0.277	3.61	0.215	4.65	0.176	5.69	0.149	6.73	0.129	7.77

* Includes outside (F_o) and inside (F_i) air film resistance. For F_i, C = 1.65 and R = 0.61. For F_o, C = 6.00 and R = 0.17.

** Roofing 0.15" thick (1.34 lbs. per sq. ft.), covered with gravel (0.83 lbs. per sq. ft.). combined assumed thickness 0.25", weight 2.17 lbs. per sq. ft. (C = 1.33, R = 0.75).

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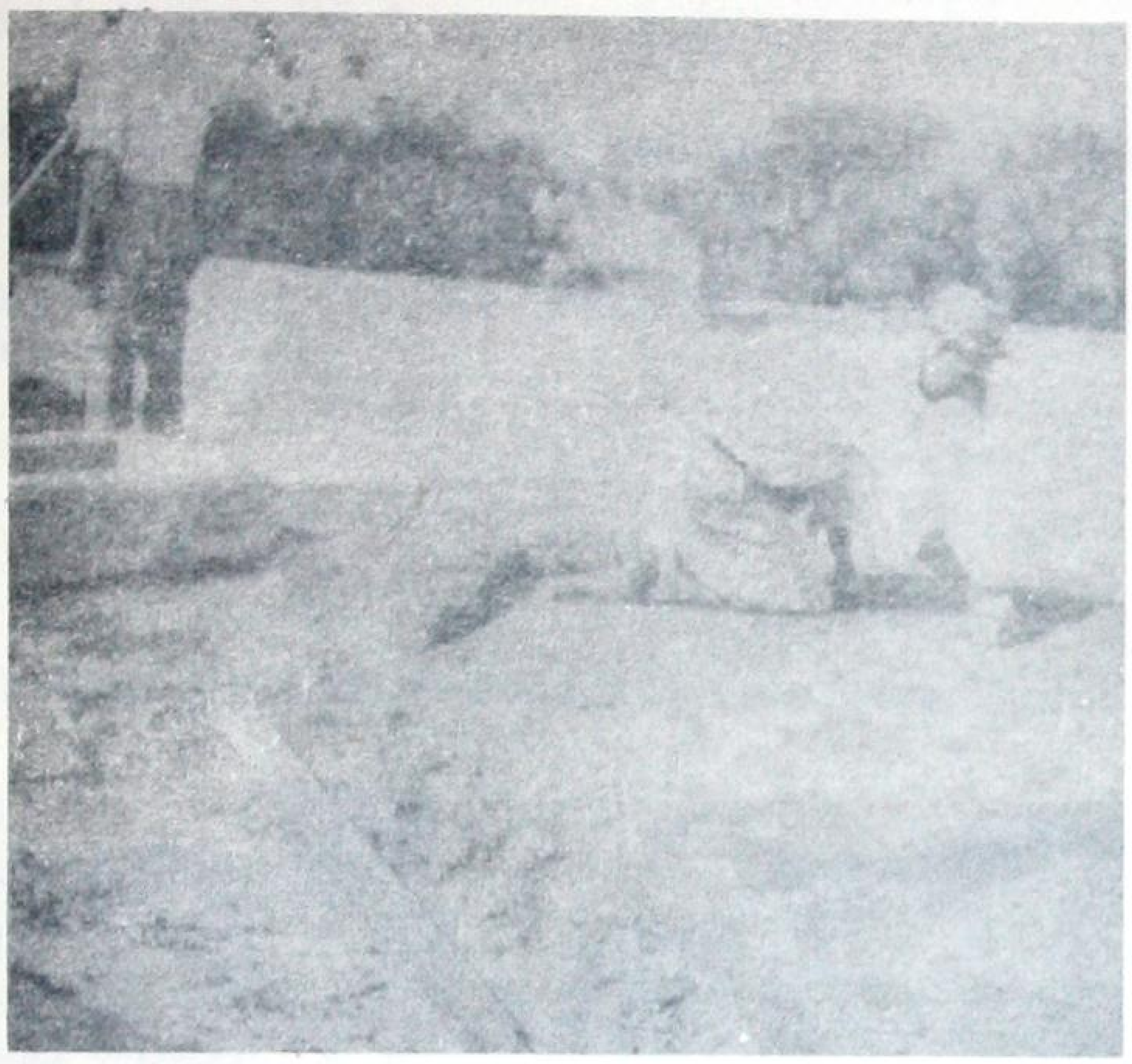
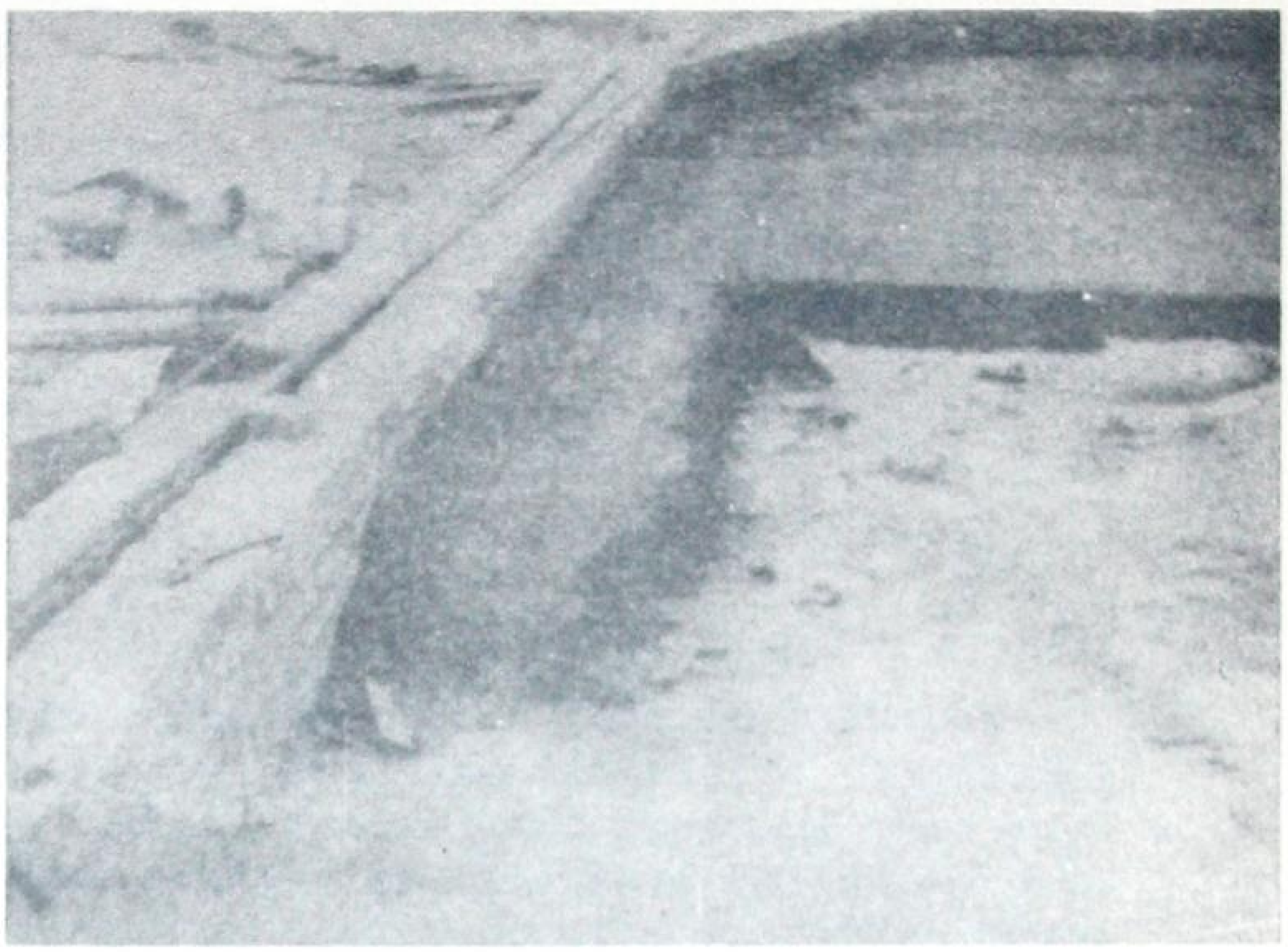
VERMICULITE INSULATING CONCRETE
"ROOF & FLOOR FILL"



Trowel Finishing Vermiculite Concrete



Cant strip formed of Vermiculite Insulating concrete.

Placing Vermiculite concrete floor fill.

Placing Vermiculite insulating concrete roof fill 4" thick.

By varying the proportions of cement and aggregates as outlined below the following densities, compressive strengths and insulating values may be obtained.

MIX BY VOLUME				
TARTAN VERMICULITE CONCRETE AGGREGATE	PORTLAND CEMENT	DENSITY IN LBS. PER CU.FT.	COMPRESSIVE STRENGTH IN LBS. PER SQ. IN.	THERMAL CONDUCTIVITY IN B.T.U.PER SQ.FT.PER HR. PER INCH, PER DEGREE F.
10	1	22	40	0.72
8	1	26	150	0.76
6	1	35	250	0.86
4	1	45	450	0.98

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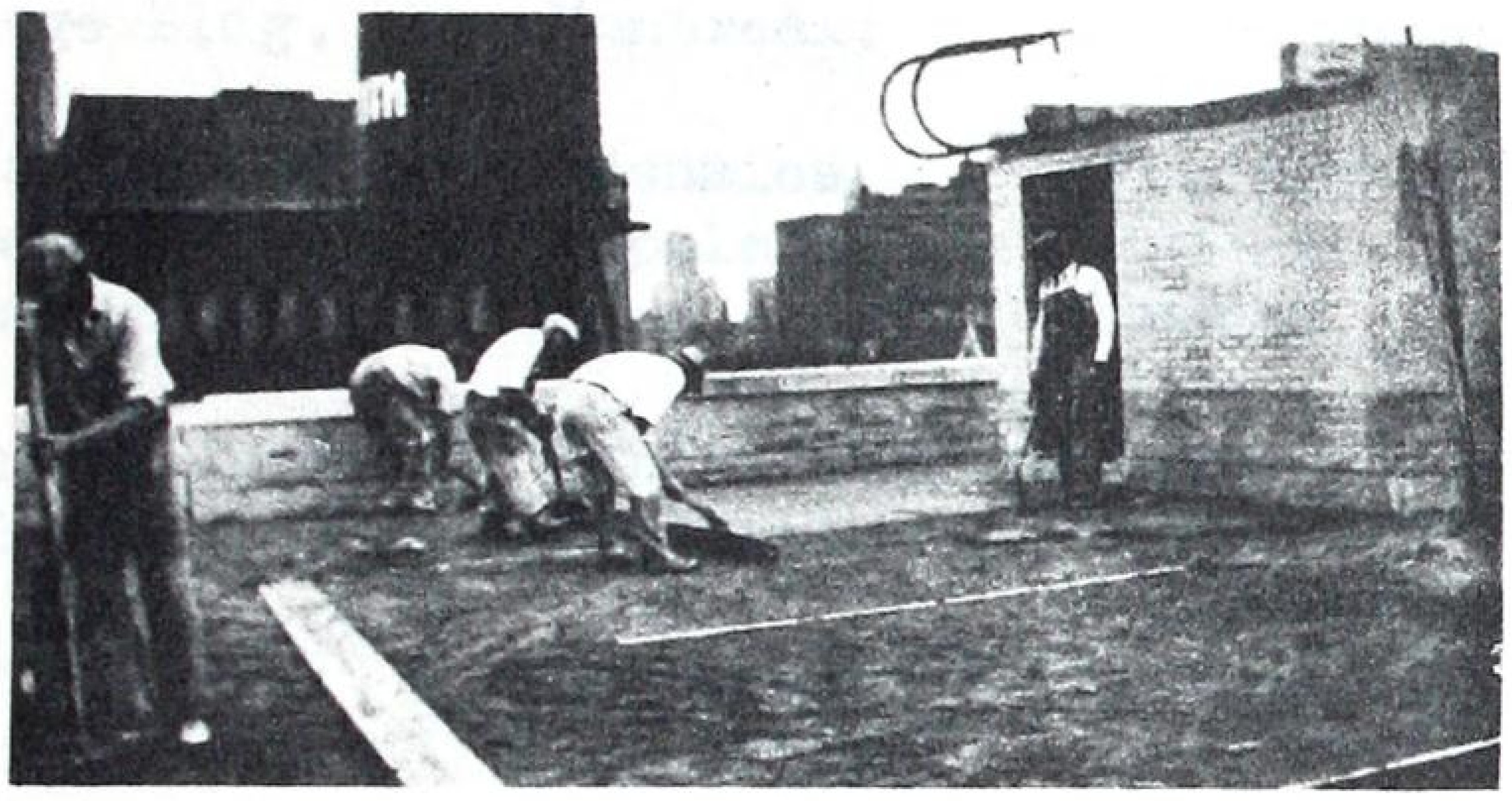
TARTAN INSULATING CONCRETE

ECONOMICAL:

TARTAN INSULATING Concrete serves a dual purpose. Being placed on the roof at varying thicknesses it gives the slope for proper drainage and at the same time meets the insulation requirements of the construction. By combining both insulation and roof fill requirements in one material TARTAN INSULATING Concrete effects economies in both labor and material.

PERMANENT:



TARTAN INSULATING Concrete is a fireproof, rotproof insulation that fits in with the other permanent type materials. Continuous exposure to wetting and freezing over extended periods of time have failed to produce rot or disintegration in TARTAN INSULATING Concrete. Becasue of its relatively high compression strength and permanence it makes an ideal base for roofing materials. It affords a continuous strong base and practically eliminates the possibility of puncture in the roofing membrane which result where roof insulation has low resistance to indentation.

SOUND DEADENING:

Because of its lightness and relatively low sound transmission value, the TARTAN INSULATING Concrete materially enhances the sound deadening value of the floor construction.

INSULATION VALUE:

The TARTAN INSULATING Concrete fill adds to the insulation value of the floor construction also, and will aid the maintenance of even temperatures throughout the building. The entire roof area utilizes TARTAN INSULATING Concrete for insulation fill. The advantages of lightness, insulating value, and permanence to be gained through the use of TARTAN INSULATING Concrete are rapidly extending its use to almost every type of construction.

EASY TO INSTALL:

TARTAN INSULATING Concrete is mixed and placed like ordinary concrete but is easier to handle because of its lightness. A cubic foot of the TARTAN INSULATING Concrete used for insulating roof fill weighs only 26 pounds, compared to ordinary concrete which weighs about 150 pounds per cubic foot, TARTAN INSULATING Concrete effects great reduction in dead weight.

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Partial List of jobs made with:-

TARTAN VERMICULITE INSULATING CONCRETE.

JOB	ARCHITECT	CONTRACTORS	SQ.FT.AREA	TYPE OF WORK
Shawinigan Chemicals Co.Power House	Owner	Shawinigan Engineering Co.	1,600	Roof Fill
Provincial Transport Garage	Shorey & Ritchie	A.F.Byers & Co.	45,000	Roof Fill
Distillers Corp. Storage Bldg.	Brian Perry Enrg. Montreal.	A.F.Byers & Co.	25,000	Roof Fill - Also between brickwork & concrete floor Slabs.
St.Joseph Church Drummondville	Deshaies Nicolet	Poudrier & Boulet, Quebec.	20,000	Cast in place roof deck over metal lath.Floor fill in basement.
Dominion Stores Warehouse	Ernest Barott, Montreal.	Louis Donolo, Montreal.	30,000	Roof Fill.
Theater Cartier Shawinigan	Denoncourt & Lacoursiere.	G.Arseneault,	5,150	Cast in place roof deck over metal lath.
General Hospital	Owner	Dept.of Public Works,Government of New Foundland.	7,000	Roof Fill.
City Hall Granby,Que.	Paul Lapointe & Sheldon Ross.	J.A.Verret Ltd. Sherbrooke,Que.	10,500	Roof Fill.
Lion Grinding Wheel Brockville.	Owner	Owner		Cast in place with reinforcing roof deck in area around chimney of the kiln.
Asten Hill Co. Valleyfield.	Brian Perry,	J.S.Hewson & Co.		3"of Insulating concrete fill around 24" chimney flues between brickwork & flues.
Walk In Cooler Box,St.Johns,Que. Laurin & Frere, Prop.	Owner	Owner		On floor 6" of Insulating concrete over structural concrete base under cement topping.Also 5" loose fill on ceiling,4" loose fill in walls.
Bell Telephone	Owner	Cook & Leitch,		Insulating Concrete fill around chimney flues.

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COMPARATIVE INSULATING VALUE OF VARIOUS BUILDING AND INSULATION MATERIALS

MATERIAL	DENSITY IN LBS. PER CU. FT.	THERMAL CONDUCTIVITY (K) OR CONDUCTANCE (C)	RESISTIVITY OR RESISTANCE (R)	AUTHORITY
Vermiculite	5.63	0.263	3.80	W. T. Miller-Purdue Univ.
Vermiculite	6.32	0.286	3.50	J. C. Peebles-Armour Inst.
Vermiculite		0.29	3.44	O. R. Sweeney-Iowa State
Vermiculite	5.9	0.30	3.33	W. L. McCracken-Iowa State
Vermiculite	6.2	0.317	3.15	J. C. Peebles-Armour Inst.
Vermiculite Insulating Concrete	22	0.72	1.39)	Average results of J. C. Peebles and F. G. Rowley-Univ. of Minnesota
Vermiculite Insulating Concrete	26	0.76	1.32)	
Vermiculite Insulating Concrete	35	0.86	1.16)	
Vermiculite Insulating Concrete	45	0.98	1.02)	
Vermiculite Insulating Plaster	39.9	0.85	1.18	J. C. Peebles-Armour Inst.
Regranulated Cork	8.10	0.31	3.22	U.S. Bureau of Standards
Redwood Bark	3.00	0.31	3.22	U.S. Bureau of Standards
Redwood Bark	5.00	0.26	3.84	J. C. Peebles
Rockwool	10.00	0.27	3.70	U.S. Bureau of Standards
Saw Dust - Various	12.00	0.41	2.44	U.S. Bureau of Standards
Shavings - Various	8.80	0.41	2.44	U.S. Bureau of Standards
Cork Board - Typical		0.30	3.33	U.S. Bureau of Standards
Cork Board - No Added Binder	14.0	0.34	2.94	U.S. Bureau of Standards
Cork Board - No Added Binder	10.6	0.30	3.33	U.S. Bureau of Standards
Cork Board - No Added Binder	7.0	0.27	3.70	U.S. Bureau of Standards
Insulating Board - Typical		0.33	3.03	U.S. Bureau of Standards
Fir-Tex	12.6	0.29	3.45	J. C. Peebles
Celotex	13.5	0.33	3.03	J. C. Peebles
Insulite	15.9	0.33	3.03	J. C. Peebles
Thermax	26.4	0.458	2.18	J. C. Peebles
Masonite		0.328	3.04	J. C. Peebles
Balsam Wool	2.2	0.27	3.70	U.S. Bureau of Standards
Cabots Quilt (Eel Grass)	4.6	0.26	3.85	U.S. Bureau of Standards
Dry Zero (Kapok)	1.0	0.24	4.17	U.S. Bureau of Standards
Hairfelt	11.0	0.25	4.00	J. C. Peebles
Brick - Low Density		5.0	0.20	
Brick - High Density		9.2	0.11	
Concrete - Typical		12.0	0.08	
Cinder Concrete	97.0	4.9	0.22	F. B. Rowley- U. of Minn.
Burned Clay Aggregate Concrete	75.0	4.0	0.25	F. B. Rowley
Blast Furnace Slag Aggregate Concrete	76.0	1.6	0.63	J. C. Peebles
Typical Hollow (4") Clay tile		1.00*	1.00	
Plaster Board 3/8"		3.73*	0.27	
Plaster Board 1/2"		2.82*	0.35	
Asbestos Shingles	65	6.00*	0.17	J. C. Peebles
Asphalt Shingles	70	6.50*	0.15	J. C. Peebles
Wood Shingles		1.28*	0.78	
Plaster - Cement		8.00	0.13	A. C. Willard
Plaster - Typical Gypsum		3.30	0.30	
Metal Lath & Plaster 3/4"		4.40*	0.23	
Asphalt Composition Roofing	70	6.50*	0.15	J. C. Peebles
Roofing - Built up 3/8" thick		3.53*	0.28	
California Redwood	22	0.74	1.35	F. B. Rowley
Douglas Fir	26	0.76	1.32	F. B. Rowley
Yellow Pine		1.00	1.00	J. C. Peebles
White Pine	31.2	0.78	1.28	U.S. Bureau of Standards
Air Spaces over 3/4" thick		1.10*	0.91	F. B. Rowley
Still Air Surface Film		1.65*	0.61	F. B. Rowley
Surface Air Film (15 mph.)		6.00*	0.17	F. B. Rowley

*For thickness stated or used on construction - not 1" thickness.

Thermal conductivity or conductance (K or C) is the number of btu. s transmitted in 1 hr. through 1 square foot of material 1" thick when the temperature difference between the hot and cold side is 1° F.

Resistivity or resistance (R) is the number of degrees F. difference in temperature required between the two sides of a material to force 1 btu. through a 1" square section of the material in 1 hr. $R = \frac{1}{K}$ or $\frac{1}{C}$

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